

What we know  
and what we don't know  
about...

the base of the aquatic food web in  
**Suisun Marsh**

"**Swamp Stew & Bog Brew**"

Anke Mueller-Solger, DWR & UCD

# Outline

- Introduction: Swamp Stew & Bog Brew
- Phytoplankton
- Zooplankton growth & food
- POM, DOM & Microbes
- Final thoughts

Water column only!  
(pelagic food web)

- Introduction:  
What are

# "Swamp Stew & Bog Brew?"

And what are they  
good for?



# Food chain

**Swamp Stew**



**Bog Brew**

DOM: Dissolved Organic Matter

Burial & export



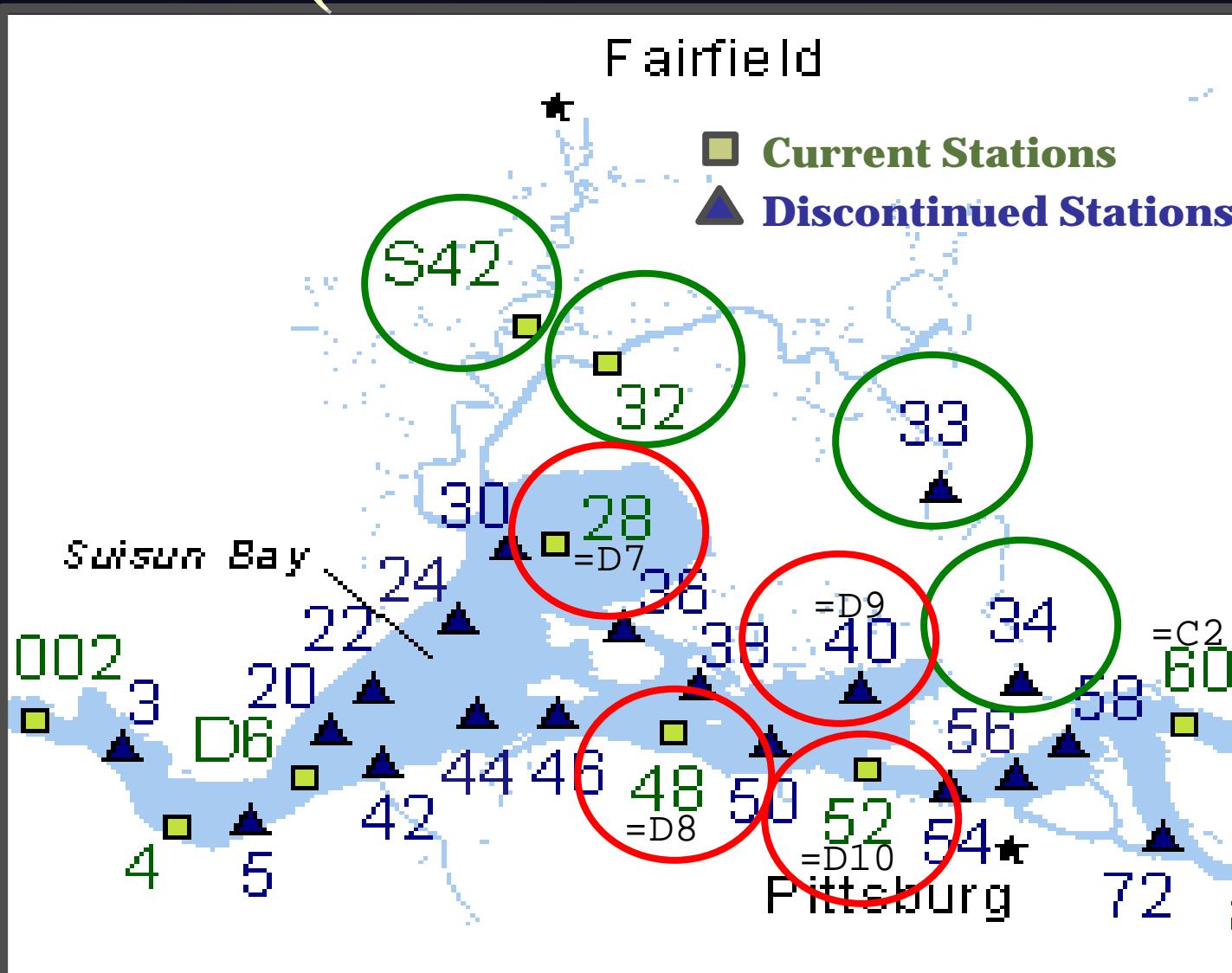
## II. Phytoplankton



aquatic  
primary  
producers

# IEP Suisun **MARSH** & **BAY** stations (DFG & DWR & USBR)

*Phytoplankton  
biomass  
(chlorophyll a)  
monitoring*



## Marsh Stations

S42: 1972-ongoing  
32: 1972-ongoing  
33: 1972-1977  
34: 1972-1984

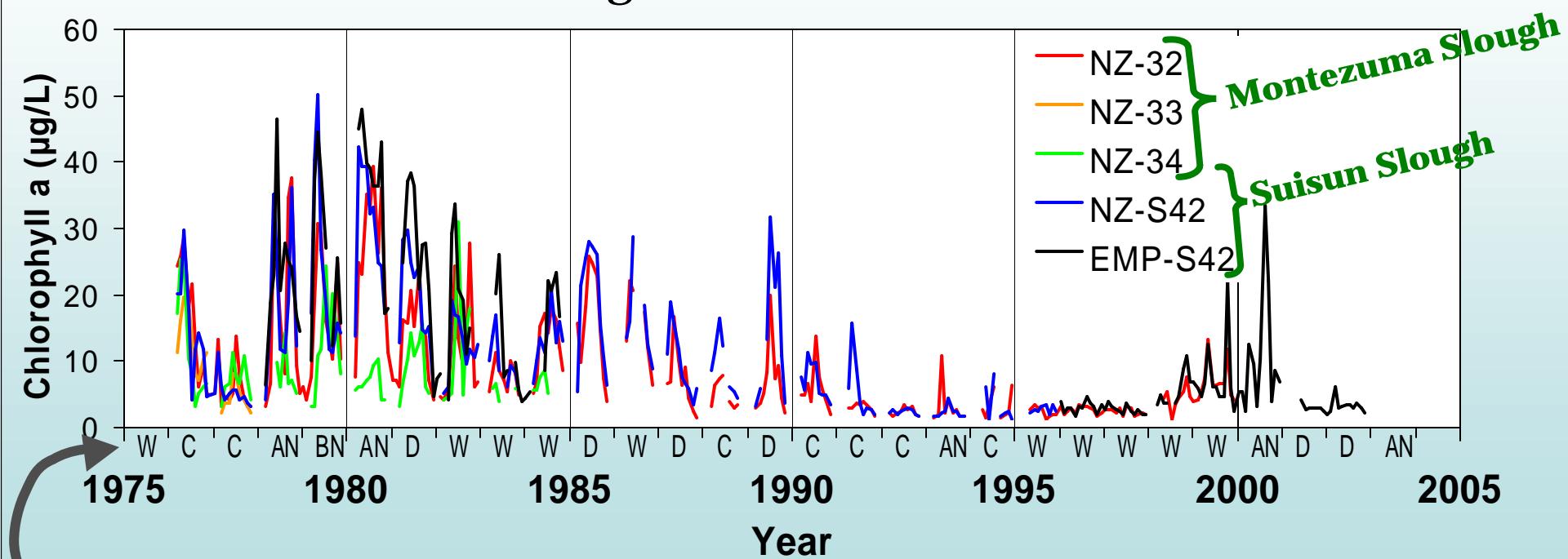
## Bay Stations

28/D7: 1972-ongoing  
40/D9: 1972-1995  
48/D8: 1972-ongoing  
52/D10: 1972-ongoing

# Phytoplankton in Suisun Marsh

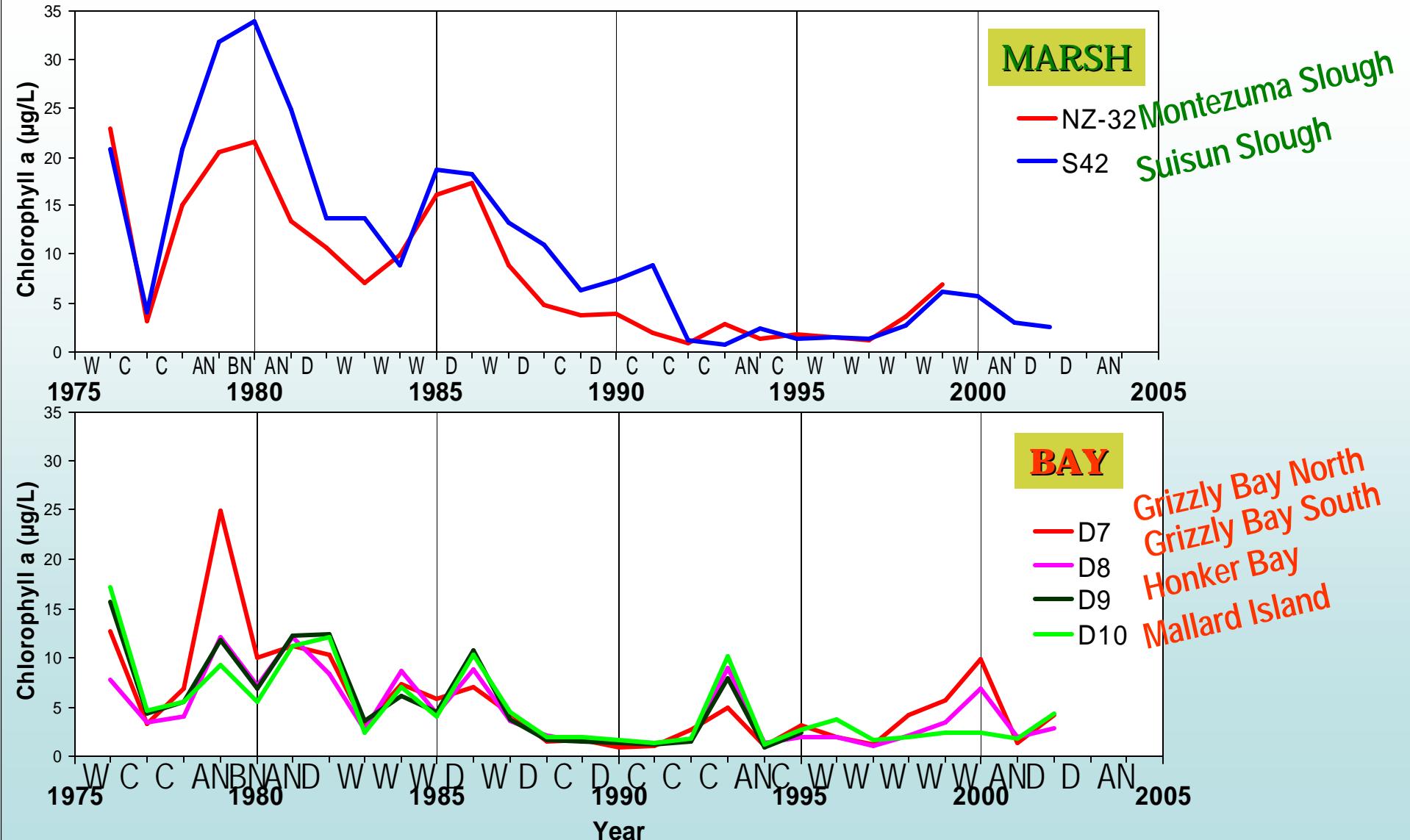
## Chlorophyll a at IEP Suisun Marsh stations

Strong decline since 1976!



Sacramento Valley Water Year Type: W = Wet, AN = Above Normal, BN = Below Normal, D = Dry, C = Critical

# Spring (March-June) Chlorophyll a declines at IEP Suisun **MARSH** & **BAY** stations



# **IEP Suisun Marsh & Delta annual trend statistics**

## **Significant chlorophyll a declines in Suisun Marsh, DFG stations 1976-2001:**

S42: 0.45 µg/L per year; NZ-32: 0.28 µg/L per year  
(Jassby et al., unpublished)

## **Significant chlorophyll a decline in the Delta, EMP stations, 1975-1996:**

0.2 µg/L per year  
(Jassby, Cloern, & Cole 2002, L&O 47: 698–712)

**Suisun Marsh chlorophyll a declines >>> Delta declines!**

**Also significant declines in all zooplankton species in Suisun Marsh & the Delta (1972-2001)**

(Trend Magnitudes: Theil slopes; Trend Significance: Seasonal Kendall Test)

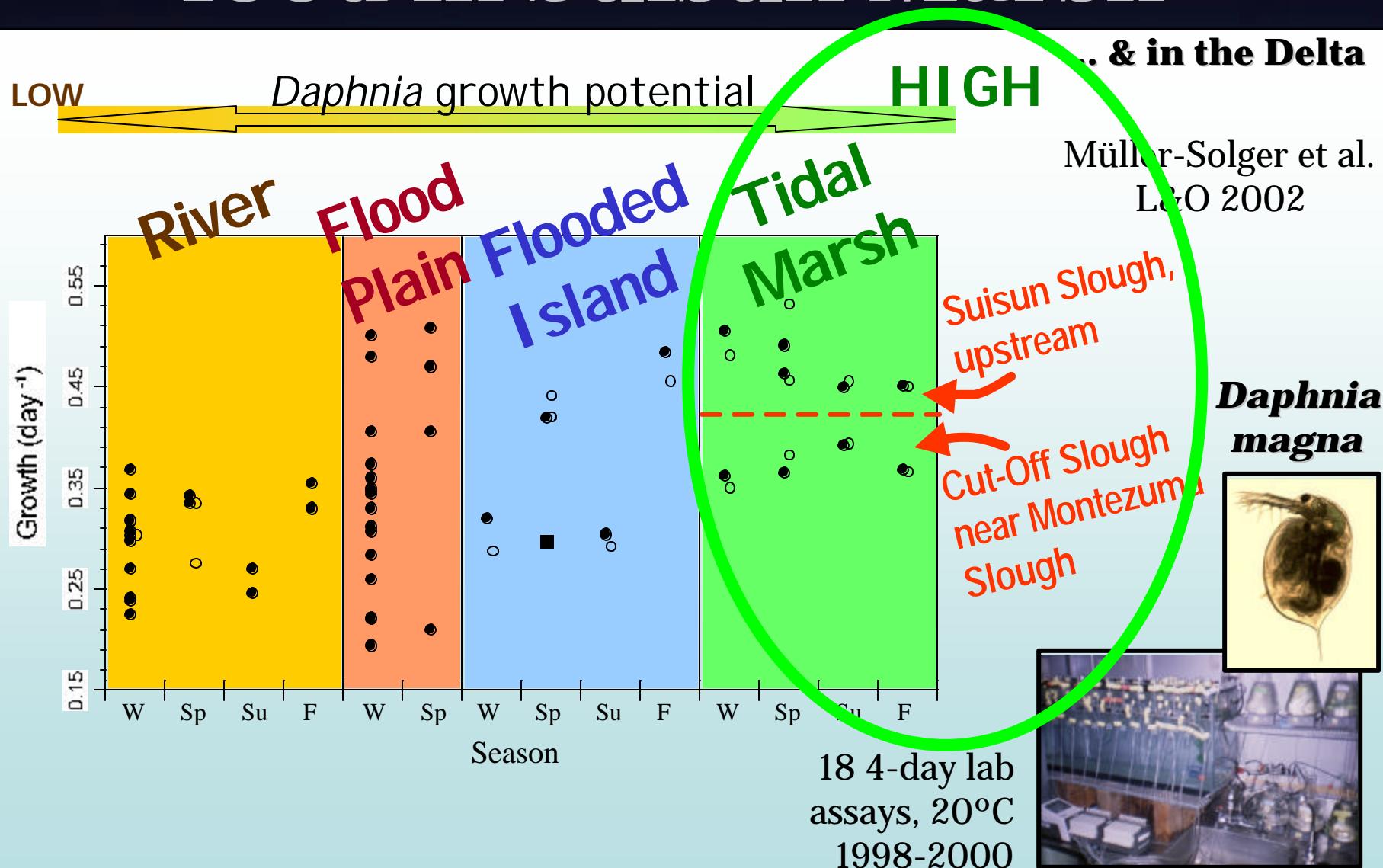
# Reasons for declines?

- The clam....
- Hydrology & Plumbing?
- Land use??
- Other???



- ❖ Restoration actions?  
(Is there hope?)
- ❖ What about smaller/  
interior sloughs?

### III. Zooplankton growth & food in Suisun Marsh



# Zooplankton (*Daphnia*) growth & food, cont.

Habitat:

**POC (mg L<sup>-1</sup>)**



River  
Flood-  
Plain

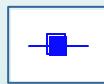
Flooded  
Island

Tidal Marsh  
Cut-  
Off

Suisun

**Daphnia Growth**

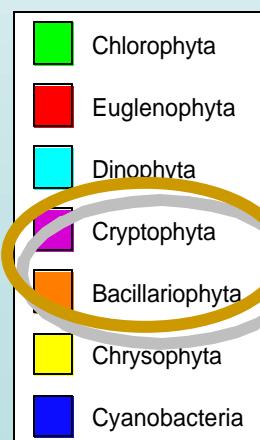
(day<sup>-1</sup>)



Season:

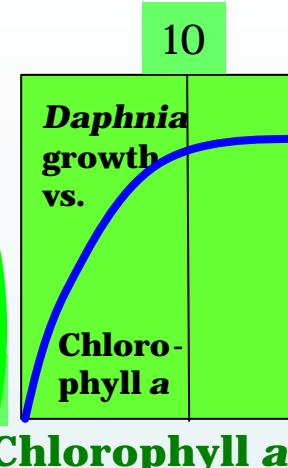
**Phytoplankton  
Biovolume**  
(\*10<sup>6</sup> μm<sup>3</sup> L<sup>-1</sup>)

W Sp Su F W W Sp W Sp Su F W Sp Su F W Sp Su F W Sp Su F



Season:

Müller-Solger et al.  
L&O 2002



# Zooplankton growth & food in Suisun Marsh

## Conclusions:

POC, chlorophyll a, phytoplankton biovolume,  
*Daphnia* growth potential (magnitude & stability):

**Upstream**      **Downstream**      **Delta**  
**Suisun Slough** > **Cut-off Slough** >  
Less exchange      More exchange

- ❖ Are more interior sloughs a “productivity refuge?”
- ❖ Restoration targets?
- ❖ How about other food sources?

# Food web



# IV. POM, DOM & Microbes



# POM & DOM Bioavailability

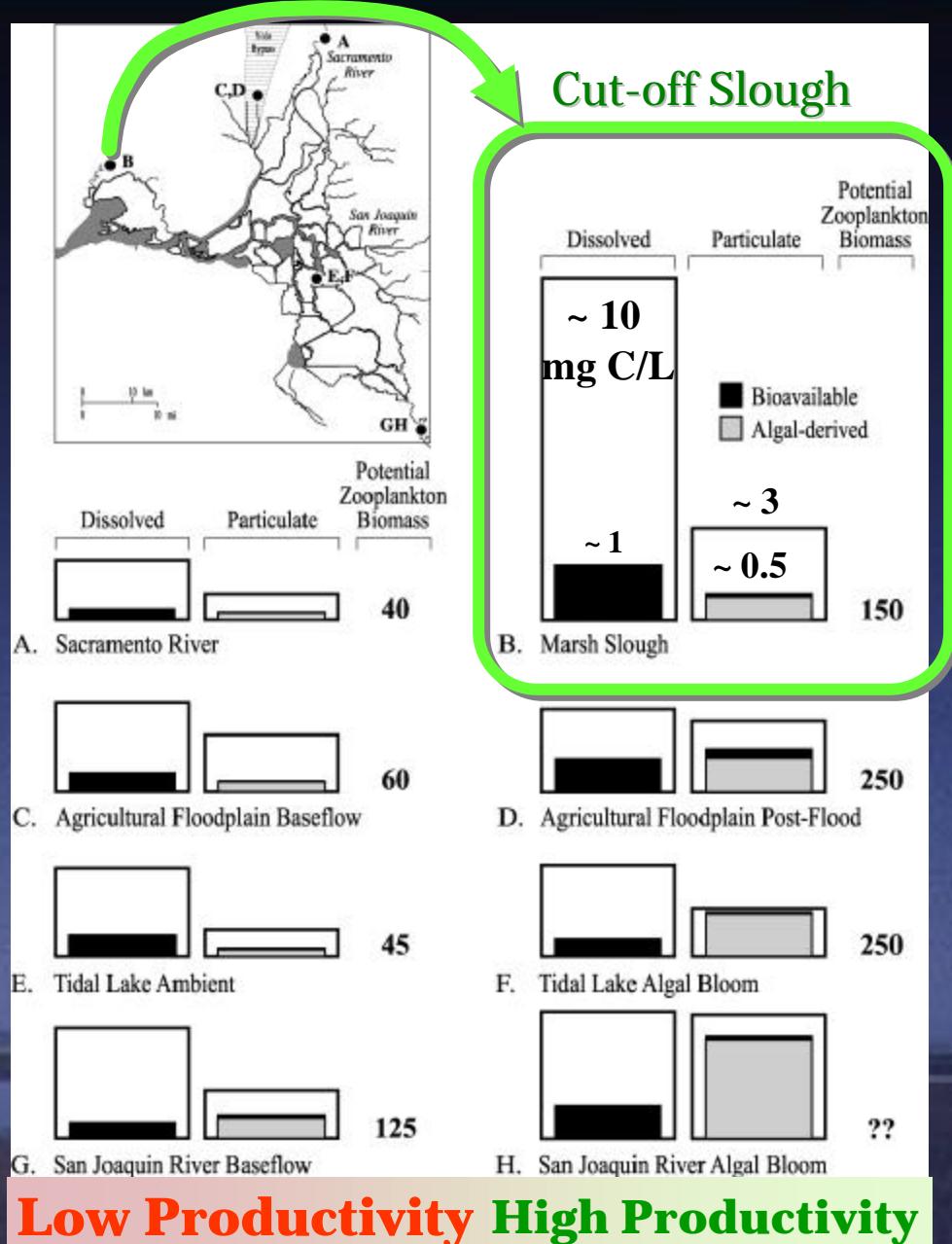
$< 1 \mu\text{m}$        $> 1 \mu\text{m}$

Organic Matter (OM)

# POM & DOM Bioavailability in Suisun Marsh & in the Delta

Sobczak et al., PNAS 2002  
& in review, L&O

Oct. 1998 - Jul. 2000:  
10 Bioavailability  
Assays:  
Algal & detrital-OC  
loss after 21 days  
(dark, room  
temperature)



# POM & DOM Bioavailability in Suisun Marsh:

From: Sobczak et al., 2002, PNAS 99: 8101–8105 & in review, L&O:

Approach: Oct. 1998 - Jul. 2000: 10 Bioavailability Assays = Algal & detrital-OC loss after 21 days (dark, room temperature); Suisun Marsh Site: Cut-off Slough

**Suisun Marsh > Delta (Baseflow)**

Total, Bioavailable, & Refractory DOC,  
& Total, Bioavailable, & Refractory POC



# Thanks!

Especially to:

Alan Jassby

Bill Sobczak & Jim Cloern

Lee Meecum & Jim Orsi

Marc Vayssieres

& MANY others!